

THE REDISCOVERY OF *HIRUDO ELEGANS* GRUBE, 1867

LAURENCE R. RICHARDSON

ABSTRACT

Leeches from Rockhampton (Queensland), Grafton (New South Wales), and Port Moresby (Papua), are recognised as *H. elegans*, the type for the genus *Goddardobdella* Richardson, 1969 (F. Richardsonianidae Richardson, 1969). *G. elegans* is monostichodont; pharynx and associated structures, hirudoid; salivary papillae present on the jaws; pharynx terminates at viii/ix; crop with 11 caecate compartments, a single pair of simple median caeca on ix to xi, a simple small anterior and larger pair of median caeca on xii to xix; epididymis in xii essentially posterior to the ejaculatory bulb in xi; median regions of reproductive system bimyomeric, mesomorphic; vagina simple fusiform; no vaginal duct. Small. Longitudinally striped. Aquatic. Sanguivorous.

Grube (1867) briefly described a glossiphonid, *Clepsine octostriata*, and two other leeches, *Hirudo elegans* and *H. novemstriata* from Rockhampton, Queensland. In 1871 he provided some few further details and in error referred to the original account as published in 1866. None of these leeches have been recognised since, nor referred to other than listed (e.g. Vaillant, 1890, etc.) excepting that Goddard (1909) considered *novemstriata* to be a synonym of '*Limnobdella*' *australis* which Johansson (1911) did not accept. From the nature of Grube's description, I considered that these species could not be recognised again with confidence excepting in material from the original area (Richardson, 1968). Following the recent war, I was advised that Grube's collections had been destroyed.

Through Mr. R. B. J. Pilbeam, M.L.A., Mayor of Rockhampton, I was placed in touch with the Rockhampton Field Naturalists' Club. The club collected and sent me seven leeches from Mount Lizard at Yeppoon. I received them on August 27, 1967, in excellent condition.

They were longitudinally striped hirudinids of moderate size. There is a median dorsal stripe, and two pairs of dorsal lateral stripes, all with narrow black borders. The median is the widest, reddish to reddish fawn in colour, commencing anterior to the first pair of eyes at the dark margin of the velum and extending posteriorly onto the dorsum of the sucker. A blackish brown to dark slate band which is wider than the median stripe along most of the body, separates the median from the inner of the lateral stripes which are both narrow and lighter coloured than the median, the outer slightly the wider, and the two separated by a narrower blackish brown band. There is a dark

greyish marginal band external to the outer lateral stripe and this band extends onto the submarginal area where it is separated from the immaculate uniformly light brownish orange venter by a distinct darker blackish grey band. The eyes are typical, there being the length of an annulus between 3 and 4, and of two annuli between 4 and 5.

Grube (1867, 1871) had knowledge of '*H.* *australis*' but makes no comparison with this species in his descriptions of the Rockhampton hirudinids which can be taken as indicating that they differ strikingly from *australis*. The descriptions are brief and refer only to general external features. In *H. elegans* the eyes are as in *H. medicinalis*, the venter uniform pale olive without a lateral black stripe and the edge somewhat paler. On the dorsum a median stripe with delicate black borders commences near the front margin between the eyes and extends onto the dorsum of the posterior sucker more or less dividing it. On each side are two stripes of less intense colour, each delicately black bordered, the inner commencing behind the eyes and the other further posteriorly. The distance between these paired stripes is about equal to their width as is the distance from the lateral stripe to the margin; but the distance between the median and inner stripes is greater than the width of the median. Length, 34.5 mm; width, 7.5 mm.

H. novemstriata was strikingly slender with a transverse row of 10 papillae on all body annuli both above and below. The oral ring divided by a transverse furrow on the dorsal aspect but the following ring with only a trace of this so that the fourth and fifth eyes are separated by only a half ring (this is open to several interpretations). No median fissure on the lower surface of the velum (present in *elegans*, but this is not a fixed anatomical structure and may disappear when the sucker is fully extended as seems to be the case in this leech); the venter uniformly coloured, continuing onto the lateral edge; the dorsum with longitudinal stripes, a median and on each side four other dark stripes which are all of the same width and separated by lighter stripes of no greater width excepting those on either side of the median. Hence the pattern appears as nine dark stripes or eight light stripes. The median stripe commences between the first pair of eyes but the paired stripes commence at about the tenth 'ring'. He refers to an olive-brownish lighter basic colouration of the body. Length, 50.0 mm; width, 4.0 mm.

The Mount Lizard leeches conform to *elegans* in the relative widths of the stripes and intervening bands; the extension of the median band between the first pair of eyes and onto the dorsum of the posterior sucker; the anterior level of the commencement of the paired stripes; and the narrow black margins to the stripes. They differ only in the presence of a ventral submarginal band separating the lighter marginal band from the venter, but the intensity of the submarginal band varies and is quite lost in some of the preserved specimens.

I have no hesitation in referring the Mount Lizard leeches to *H. elegans*. Leeches from Alamy Creek, Grafton, N.S.W., conform in size, form, colour, pattern, annulation, and in the morphology of the alimentary and reproductive systems, and I recognize these also as *H. elegans*.

I cannot completely satisfy myself that the two species Grube described are in fact distinct. It is clear that *novemstriata* was well extended. In this condition, the furrows

v a_1a_2/a_3 and vi a_1/a_2 which are dorsal and do not continue onto the ventral surface can be separately either one or both, partly or totally lacking which would agree with Grube's statement concerning the separation of the fourth and fifth pairs of eyes. Full extension accentuates longitudinal markings such as the black marginal lines in *elegans*. In several specimens of *elegans* from Grafton, the longitudinal stripe in the dorsal median field is dark and margined by narrow light stripes which include the paramedian sensillae. This then gives six light stripes on the dorsum and seven dark bands; but I have not yet seen a specimen which fully conforms to Grube's description of *novemstriata*. If *elegans* and *novemstriata* should prove to be the one species, *elegans* has page priority.

I have found so far (Richardson, 1969) that the jawed sanguivorous hirudinoid leeches of the Australian Region are monostichodont and with only one exception possess an hirudoid pharynx: bulbous, muscular, attached to the body-wall by obvious extrinsic radial muscles, terminating no further posteriorly than ix/x, and carrying six internal muscular ridges as a dorsomedian pair and two ventrolateral pairs, each pair joining anteriorly to enter as a single ridge into the appropriate jaw. There are no ridges ending independently on the margin of the entrance to the pharynx between the bases of the jaws. The entrance to the pharynx and the lumen of the pharynx are narrow, the entrance little wider than the base of the dorsomedian jaw, and the lumen tapers posteriorly. The three jaws are housed in open recesses. This is associated with a crop divided into compartments, each compartment carrying one or more pairs of caeca, and the last pair of caeca extending as postcaeca into xxv and further. The one exception is *Hirudobdella antipodum* (Benham, 1904), known only in Benham's two accounts (1904, 1907) which make it clear that the pharynx extends to at least xii/xiii, the crop has only five pairs of caeca, the vagina is acaecate, etc. With these features, *H. antipodum* stands apart not only from the jawed aquatic leeches of the Australian Region, but from all other jawed leeches.

The nature of the pharynx separates the Australian jawed aquatic leeches from those of the American Region of the F. Macrobdellidae Richardson, 1969, as also from the macrophagous jawed and agnathous leeches of the Northern Hemisphere and South America which I have placed together for the time being in a F. Haemopidae. Afro-Asian jawed aquatic sanguivorous leeches cannot be properly systematised at this time, nor until they have been restudied, for critical information is lacking for most species and especially for the species which are the types of many genera; but there are clear indications on other evidence of two groups recognisable at this time, the one group having an acaecate vagina, the other with the vagina caecate.

So far five genera of the Australian Region all have the vagina caecate; but differ from those of Europe and Afro-Asia having this character—as also from the Macrobdellidae and Haemopidae—in having an essentially linear and not subparallel relationship of the epididymis and ejaculatory bulb on the anterior portion of the paired male ducts, the epididymis being essentially in xii and posterior to the ejaculatory bulb which is in xi

Following from my indications that *Hirudo australis* Bosisto, 1859, could not be congeneric with *Limnobdella mexicana* Blanchard, 1893, on the evidence provided by the persistent exploration of the leech fauna of Mexico over many years by Dr. Ed. Caballero, evidence fully supported in my study of specimens kindly sent me by Dr. Caballero, Dr. A. Soos re-examined Blanchard's type-material in the collections of the Zoological Institute and Museum of the University of Torino, confirmed that these were "potamobdellid" or "pintobdellid" in nature, and provided a new genus, *Richardsonianus* for *australis*. On this basis I have established the F. Richardsonianidae for five of the genera of jawed aquatic sanguivorous leeches so far known for the Australian Region. The genera *Ornithobdella* Benham, 1909, and *Aetheobdella* Moore, 1935, stand together in a second family, the F. Ornithobdellidae, both known species having simple miniature non-muscular atria on both the male and female median regions and entirely lacking strong muscular organs in these regions.

Family RICHARDSONIANIDAE Richardson, 1969.

Monostichodont; pharynx and associated structures, hirudoid; anterior end of the paired male duct linear, without loop-formation, epididymis essentially in xii posterior to the ejaculatory bulb in xi; median reproductive structures bimyomeric (or secondarily hemimyomeric) male median structures mesomorphic or micromorphic; female mesomorphic; vagina caecate; vaginal duct present or absent; salivary papillae, absent or present; 15 or 16 5 annulate somites. Freshwater. Sanguivorous. The Australian Region. Type genus *Richardsonianus* Soos, 1968.

Genus *Goddardobdella* Richardson, 1969.

TYPE SPECIES: *Hirudo elegans* Grube, 1867. Rockhampton, Queensland.

Richardsonianidae. Jaws with salivary papillae; pharynx short, terminating at viii/ix; crop with 11 caecate compartments, a single pair of small simple median caeca on ix to xi, a pair of small simple anterior caeca and a pair of larger simple median caeca on xii to xix, the larger caeca extending into the following somite and those of xix reaching to xxv/xxvi; bimyomeric; male and female median regions mesomorphic; common oviduct loosely coiling, longer than oviducts and of the length of the vagina; vagina simple fusiform with a small caecum; no vaginal duct; 15 5-annulate somites.

Two specimens, one dissected and figured in this paper, from Mount Lizard, near Yeppoon, are deposited in the Queensland Museum, Reg. No. G5116 and G5117. Two from Mount Lizard (Reg. No. W4172) and two from Alamy Creek, Grafton, N.S.W. (W4173), are deposited in the Australian Museum. These are all *Hirudo elegans* Grube, 1867, by my identification.

Leeches taken from an irrigation ditch, Laloki River, Port Moresby by Mr. L. J. Jones in March 1950, are in the collections of the Australian Museum, Coll. No. 4192. These have 15 complete somites; salivary gland papillae on the jaws; genital pores xi b_5/b_6 and xii b_5/b_6 ; the epididymis posterior to the ejaculatory bulb; the penis sheath a simple posterior primary loop with the two limbs equivalent in length; a caecate vagina; no vaginal duct; the common oviduct thin-walled, wide and sinuous. The colour pattern on the dorsum has the light stripes as in *elegans*, but the dark paramedian and intermediate bands are partially to almost completely reduced to narrow black stripes by olive to olive grey, and these stripes then appear as black margins to the median and the intermediate paired stripes. There is variation.

This is the first knowledge of an aquatic jawed sanguivore from New Guinea and Papua. I can see no reason to separate these specimens from *Goddardobdella elegans* and assign them to this species with full confidence.

The genus is named in recognition of the pioneer studies on leeches in Australia by the late Professor E. Goddard.

***Goddardobdella elegans* (Grube, 1867).**

(Figs. 1, 2.)

Moderate sized colourfully striped hirudinid leeches, contracted 15.0 to 20.0 mm. long and extending to 60.0 and 65.0 mm. The first three pairs of eyes large and obvious, the fourth pair smaller, and the fifth pair somewhat concealed. A median reddish to reddish-fawn longitudinal stripe extending from the dark greyish anterior margin of the velum, between the first pair of eyes along the length of the body, and onto the dorsum of the posterior sucker where it may widen into a diamond-shaped or triangular patch. This stripe is just wider than the median field and includes the paramedian series of somital sensillae. On each side of this stripe a narrow black line lies immediately lateral to the paramedian sensillae. A blackish brown area spreads from the margin over the velum lateral to the median stripe, including the first 3 pairs of eyes but not the dorsolateral margin of the sucker which is light grey. The blackish brown area continues as a band, narrow anteriorly, widening at vi, subequal posteriorly to the median stripe and then wider than it behind xiv, narrowing again about xxiii to cross xxvii and spread over the dorsum of the sucker as a band surrounding the patch of the median stripe and excluding the patch from the posterior border. A narrow black margined yellowish grey stripe commences in iv a_3 and passes medial to the fourth and fifth pair of eyes and extends posteriorly medial to the row of intermediate somital sensillae and terminates on xxv near to the posterior border of this somite. Accordingly the paramedian field includes a wide dark band and this narrow lateral stripe. The dark brown on the velum extends lateral to this light stripe as a very narrow blackish brown band including the fourth and fifth eyes and the intermediate series of somital sensillae,

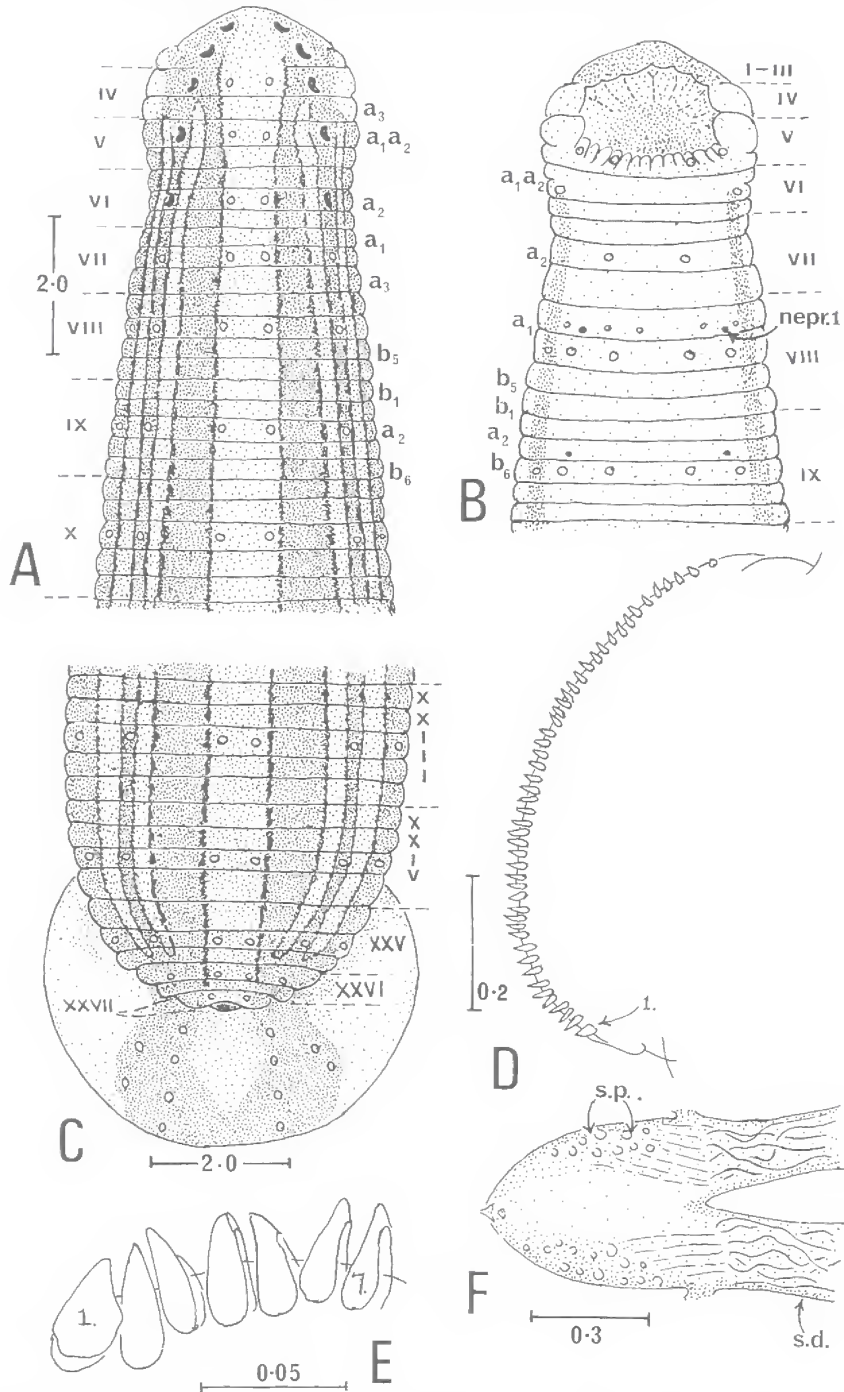


FIG. 1: *Goddardobdella elegans*. A, Dorsal view, somites i to x; B, Ventral view, somites i to ix, nepr. 1, first nephridiopore; C, Dorsal view, somites xxiii to xxvii; D, Dorsomedian jaw, side view; E, Teeth 1 to 7, median end dorsomedian jaw; F, Dorsal view of dorsomedian jaw showing salivary papillae (s.p.) and aggregated salivary ducts (s.d.) Scales in mm.

and joins the inner wider dark band behind xxv. This dark band of the intermediate line is narrower everywhere posterior to vii than the light stripe medial to it as also to the light stripe lateral to it which is yellowish grey and extends from iv/v lateral to the fourth and fifth eyes and the intermediate series of somital sensillae to terminate at the posterior border of xxv. This outer of the pair of light stripes is wider along the post-genital region than the other light stripe. It is also black-margined. The supramarginal and marginal somital sensillae lie in a greyish brown wide band, lighter than the dorsal bands and extending from iv/v to xxvii where it spreads over the lateral and anterior regions of the dorsum of the sucker. This band can be seen also along the edge of the body on the ventral surface and is separated from the immaculate light brownish orange of the venter by a darker less definite greyish black band which includes the submarginal somital sensillae.

The somital sensillae are not raised, are white, surrounded each by a white area, generally obvious; but other than this there is no metameric colouration. The more numerous secondary sensillae are seen as a transverse row on annuli other than a₂ but are very minute and show only as white points. Irregular white sensory patches are present in about 3 transverse rows each of about 20 patches on the margin of the velum and on the dorsolateral lobe of the margin of the anterior sucker, but not on the ventral margin where the ventral paramedian and intermediate somital sensillae of v are obvious.

The body is smooth-skinned, without cutaneous papillae and not obviously divided by delicate longitudinal striae. The form is simple, moderately low convex above, flat below, the margins smoothly rounded over most of the body but keeled from xxiii to xxvii. The margin of the velum is rounded or only slightly angled, lacks a median incision, and the cephalic region narrows only sufficiently to suggest a very short 'neck' at somite vi, which widens gradually over the pregenital region to xi, the sides then subparallel with the width increasing almost imperceptibly so that the region of maximum width from xvi to xxiii is little wider than anteriorly. The body narrows obtusely from xxiv to xxvii where it forms a wide basis for the sucker which is itself rounded and nearly two thirds of the maximum width of the body. The clitellum is not obvious but appears to include x b₅ to xiii b₂.

A typical preserved specimen of a total length of 52.0 mm is 3.2 mm wide at v; 3.0 mm wide and 2.0 mm deep at vi/vii; 5.0 mm wide and 2.5 mm deep at xi; 5.5 mm wide and 2.5 mm deep at xx; 3.0 mm wide at the basis of the posterior sucker which is 4.0 mm wide and of the same length.

ANNULATION: (Fig. 1 A, B, C.) The annulation is distinct and well-defined excepting on the velum. There is some indication of an arrangement into couplets and triplets, more often couplets of annuli separated by a single annulus, but no constant pattern is shown and only occasional somites are obvious as such. There is a relatively high incidence of minor abnormal irregularities in the annulation. In five specimens, only one was without such irregularities, two showed two instances, one showed three, and the fifth exhibited four areas of abnormal annulation. In no case was the somital annulation grossly disturbed.

The velum carries the first three pairs of eyes. There is no indication of furrowing across the dorsum of the velum anterior to iv/v excepting a short incision on the margin of the velum behind the level of the second pair of eyes which in some extends medially but no further than the line of the sensillae of the paramedian series. This incision marks the anterior edge of the dorsolateral lobe of the margin of the sucker and so corresponds to iii/iv and this permits recognition of iv a_1a_2 —which contains the third pair of eyes and the first pair of paramedian sensillae—as being longer than iv a_3 , so that this somite is 2-annulate. In v, $a_1a_2 > a_3$ with the fourth pair of eyes in a_1a_2 and v is strongly 2-annulate above but the furrow a_1a_2/a_3 extends only to the level of the submarginal sensillae so that a_1a_2 forms the lateral portion of the margin of the sucker but medial to this v is uniannulate and forms the ventral margin of the sucker. Somite vi is 3-annulate dorsally $a_1 < a_2 > a_3$, the fifth pair of eyes being in a_2 ; a_1/a_2 is weak, may not show in the median field but only at the margins, and is lacking below where vi is 2-annulate and $a_1a_2 > a_3$. Somite vii is fully 3-annulate with $a_1 < a_2 < a_3$; vii $a_3 =$ viii a_1 . Somite viii is 4-annulate with $a_1 > a_2 > b_5 = b_6$. The lesser sensillae in viii a_1 are slightly posterior in the annulus. The first pair of nephridiopores are posterior in viii a_1 and just medial to the line of the ventral intermediate somital sensillae. Somite ix is 5-annulate with $b_1 = b_2 < a_2 > b_5 = b_6$ which is the same also in x to xiii but behind this the annuli are more or less subequal with a_2 if anything little longer than the other annuli back to and including xx. In xxi $b_1 = b_2 < a_2 > b_5 = b_6$ as also in xxii, and xxiii which is the last 5-annulate somite. Accordingly there are 15 5-annulate somites. In xxiv, $b_1 = b_2 = a_2 < a_3$ and somite xxiv is very distinctly 4-annulate and carries the last pair of nephridiopores close to the posterior edge of b_2 . Somite xxv is 3-annulate, $a_1 (= \text{xxiv } a_3) > a_2 > a_3$ and xxv a_3 is the last annulus which is complete on the venter. Somite xxvi is 2-annulate, $a_1a_2 > a_3$ and with the somital sensillae posterior in a_1a_2 . Somite xxvii is uniannulate and forms the dorsal and lateral margins of the anus. The dorsum of the posterior sucker variously shows indications of four to five rows of somital sensillae.

The genital pores are at xi b_5/b_6 and xii b_5/b_6 . There are no indications of copulatory glands or other similar accessory reproductive structures in this vicinity and the annulation is undisturbed. The nephropores are 17 pairs as usual, small, in some obscure but in most mounted on low-mounded cutaneous papillae.

ALIMENTARY CANAL: (Figs. 1D–F, 2G.) The three jaws are small, about 0.75 mm long, a little taller (0.4 mm) than wide (0.35 mm), low in profile and armed along the entire edge with a single row of about 48 acutely conical sharp spaced teeth, the tallest (0.04 mm) at the medial end and diminishing in height very gradually so that the fortieth tooth is about 0.028 mm high and only the last one or two teeth are granular. Along the sides of the jaw there are many openings of salivary ducts which might be termed salivary papillae but in general they are so low as to hardly disturb the profile of the jaw and are seen as small rounded barely elevated white areas not arranged in any obvious pattern.

The acini of the salivary glands extend through vii to x a_2 . They are relatively large, semitranslucent, whitish, not crowded but showing more as distinct individual bodies in loose, not compacted, aggregations. The individual ducts are minute, almost trans-

parent, and those on the dorsal aspect of the pharynx and first crop compartment aggregate into main right and left trunks separated by a row of extrinsic muscles of the pharynx, almost concealing the body of the pharynx but quite readily separated and raised from it, and the two trunks enter the median dorsal jaw at vii a_2 . The individual ducts appear to follow a tortuous course in these trunks.

The pharynx commences at the mouth proper at the base of the jaws at vii/viii, is thin-walled so that the intrinsic muscle layers are not individually obvious, and internally it shows only six very low narrow longitudinal folds. The radial extrinsic muscles are mostly comparatively short, spaced, and are located in vii to ix.

The pharynx terminates at viii/ix. The crop commences in ix with a complete compartment of the full length of this somite, carrying a single pair of short simple caeca which originate half-way along the compartment, the length at their origin is about one third of the length of the compartment and they penetrate the array of dorsoventral muscles at the side of the compartment so that this compartment with its caeca is fully equivalent morphologically to the compartments in x and xi, these also having only a single pair of simple caeca each. In xii to xix, the compartments of the crop increase progressively in length and the caeca at the mid-level of each compartment perforate the dorsoventral muscles and then extend posteriorly to the level of b_2/a_2 in the following somite excepting those of xix which extend back to xxv/xxvi. These large caeca are simple. In addition to the large caeca, the compartments in xii to xix also carry a pair of small anterior simple caeca which are confined within the paramedian longitudinal array of dorsoventral muscles but are laterally plicated and could be expected to expand in the partly fed leech to show as the small anterior simple lobed caeca known in several genera. The compartment in xix narrows behind the origin of the main pair of caeca to form a narrow tube the wall of which is of the same nature as that of the crop. This tube joins the ventral face of the intestine shortly beyond its anterior end at xix/xx so that a short slightly bilobed intestinal caecum, wider than the intestine, is formed.

The intestine is thin-walled tapering, tubular, only slightly constricted at the intersomital levels, and reduced to a narrow tube at xxii/xxiii which is loosely folded in xxiii and enters the rectum in xxiv so as to form a short rectal caecum narrower in diameter than the main portion of the rectum which terminates at the anus.

REPRODUCTIVE SYSTEM: (Fig. 2H.) The female reproductive system is situated between xii a_2 and xiii a_2 . The ovaries are slightly flattened small white bodies pear-shaped in profile just anterior to xii/xiii, ventral to the crop, medial to the paramedian longitudinal row of dorsoventral muscles, and resting near the medial face of the posterior third of the epididymis. The oviducts are short, little longer than the ovary, with a few initial open coils and then straight, the left passing ventral to the nerve-cord immediately behind ganglion xii to enter the common oviduct independently from the right oviduct. The common oviduct does not show a distinct oviducal atrium, but in these specimens it is thin-walled and enlarged nearly to the diameter of the penis sheath and an atrium might be anticipated otherwise. It shows indications of a slightly tortuous path and is surrounded for its full length by a transparent gelatinous structureless

material which would seem to be an extensive albumin gland. The common oviduct extends from the floor of the body cavity along the anterior face of the vagina which it enters shortly before the end so forming a small but distinct vaginal caecum. Accordingly the common oviduct is almost of the length of the vagina. The vagina stands sub-erect lateral to the crop between the major caeca of xii and xiii, and is swollen simple fusiform below the entry of the oviduct, narrowing briefly before entering the body-wall at xii b₅/b₆ giving the appearance of a very short vaginal duct. The caecum, vagina, and the 'duct' are all of the one nature, opalescent, covered with a compact layer of fine circular fibres and accordingly to describe this organ as divided into distinct vagina and duct may be morphologically incorrect.

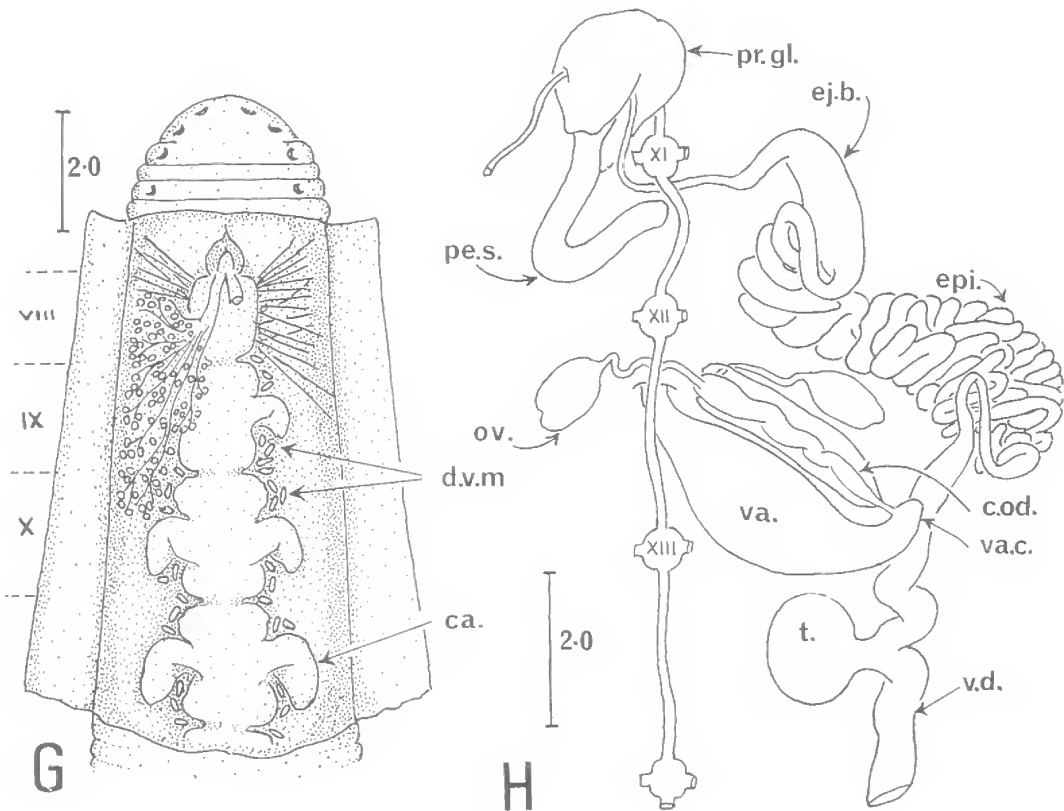


FIG. 2: *Goddardobdella elegans*. G, Dissection from the dorsal aspect showing pharynx and crop compartments with caeca (ca.) in ix to xi, dorsoventral muscles (d.v.m.); H, Dissection of reproductive system from the dorsal aspect with the vagina, epididymis and bulb turned to show the medial aspect, c.od. common oviduct, ej.b. ejaculatory bulb, epi. epididymis, ov. ovary, pe.s. penis sheath, pr.gl. prostate glands, t. testis, va. vagina, va.c. vaginal caecum, v.d. vas deferens. Scales in mm.

The male reproductive system is mature in these specimens, the testes, vasa efferentia, vasa deferentia and epididymi are swollen, enlarged and opaque white. There are 10 pairs of testes which are ventral to the crop and intestine and medial to the paramedian longitudinal row of dorsoventral muscles on either side of the alimentary canal. The vasa efferentia are short, the length less than the diameter of the testis, and pass laterally through the dorsoventral muscles of the paramedian longitudinal row to join the vas deferens on each side. The anterior pair of testes is at xiii/xiv, the posterior pair at xxii/xxiii. The vas deferens is slightly wider in diameter than the penis sheath and tortuous in its path, extending anteriorly to about xii b₅/b₆ which is apparently the end of the glandular region for at this level it diminishes to a narrow tube which turns posteriorly to about xiii b₂ to enter the posterior end of the compactly coiled tapering mass of the large epididymis which is situated for the greater part in xiii b₂ to xi/xii, lateral to the paramedian longitudinal row of dorsoventral muscles and ventrolateral to the crop. The terminal anterior portion of the epididymis is a short enlarged tube in a few compact coils which turns posteriorly to enter from below the posterior vertical limb of the small, opalescent, muscular ejaculatory bulb extending from xii b₂ to xi a₂ and so is anterior to the epididymis excepting for the terminal portion which alone is ventral to the bulb. The ejaculatory bulb is wider but not greatly wider than the penis sheath. It passes anteriorly into a vertical descending tapering limb which narrows into the delicate, short, muscular ejaculatory duct which passes through a cleft in the prostate gland to enter the male atrium independently from its fellow. The right duct passes ventral to the nerve cord. The prostate glands form a bulbous mass tapering onto the penis sheath and both are ventral to the crop and medial to the rows of dorsoventral longitudinal muscles on each side of the crop. The penis sheath is muscular, opalescent, extending from xi a₂ to xii b₂ before curving back to enter the body-wall at xi b₅/b₆. A minute filamentous penis is extruded in one specimen. It is 0.06 mm in diameter and 0.8 mm long.

DISCUSSION

The above description is based on the specimens from Mount Lizard, Rockhampton, being the original area for *Hirudo elegans*. This then enabled me to recognise with confidence that leeches taken from Alamy Creek, Grafton, N.S.W. are of the same species.

The agreement in detail between the Grafton and Mount Lizard specimens is excellent. The colour patterns are the same saving that in two of the Grafton specimens the median light stripe is a darker brownish grey for the width of the median field, with the paramedian sensillae included in a light yellowish brown stripe forming a narrow light margin to the median area, and the more obvious in contrast to the black line lateral to them. In this phase, the pattern appears to be one of three pairs of light stripes, the paramedian the narrowest, lateral to it a slightly wider stripe, and the outer stripe obviously wider than the other two.

After several weeks in a glass jar in moderate light, a dark phase of colouration developed. The median stripe is blackish brown and of the width of the median field. It is bordered by a narrow stripe which is light green with brown maculations. The lateral paired stripes are a dark blackish brown with yellowish brown maculations. The black marginal lines are replaced by dark brown, and in the pregenital region and from xx posteriorly, the lateral stripes are solid brown. The intervening bands are all brightly darkish green with black and dark brown maculations. The margin is light green and does not continue onto the venter which is slightly reddish brown.

In contraction, the annuli of the posterior somites become sharply keeled and there is some suggestion of many small papillae, but there is nothing regular or persistent.

The leeches from Alamy Creek, Grafton, were taken by High School Students on Sept. 21, 1967, from a mud bottom in standing water some six inches deep and also in submerged vegetation. They reported them as extremely abundant, in the order of 8 to a square yard. This suggests a possible mass-movement or migration such as I have reported for Canadian hirudinids (Richardson, 1942). I visited the location the following day but there were no leeches in the open at this point, nor could I see them elsewhere on the stream, which is in agreement with the sudden disappearance of the leeches in the instances seen in Canada. The only specimens I found were concealed in the axils of bull-rush, and these were few, much less common than an erpobdellid of similar size, a glossiphonid, and a *Placobdella*.

G. elegans is an essentially aquatic leech, a graceful rapid swimmer, swimming with the body in extension, mostly horizontal but equally well with the body on its side. Removed from water, they rapidly lose the ability to hold with the suckers on a dry surface and become helpless. They seem incapable of biting on the dry skin. Held in a jar, they frequently leave the water for long periods but remain little more than an inch above the surface of the water and occasionally lower the anterior half of the body into the water. This does not seem to be related to any essential requirement since while one may do so, others rest quietly on the bottom of the jar.

ACKNOWLEDGEMENTS

I am most grateful to the members of the Rockhampton Field Naturalists Club for their efforts in supplying me with leeches from their area; to Dr. R. E. Barwick, Australian National University, Dr. J. C. Yaldwyn, Australian Museum, and Professor M. C. Meyer, Orono Me., for assisting me to obtain certain literature; to Mr. P. Strong and students of the Grafton High School for leeches from Alamy Creek, Grafton; and the Science and Industry Endowment Fund for the loan of microscopic and other equipment.

LITERATURE CITED

- BENHAM, W. B., 1904. On a new species of leech (*Hirudo antipodum*) recently discovered in New Zealand. *Trans. N.Z. Inst.* **36** (21): 185–192.
1907. Two new species of leech in New Zealand. *Trans. N.Z. Inst.* **39** (16): 181–193.
- GODDARD, E. J., 1909. Contributions to our knowledge of Australian Hirudinea. Pt. iii. *Proc. Linn. Soc. N.S.W.* **34** (3): 467–486.
- GRUBE, Ed., 1867. *Jahr. Ber. Schles. Gesellsch. f. Vaterl. Cultur.* **44**: 61.
1871. Beschreibungen einiger Egel-Arten. *Arch. Naturgesch.* **37**: 87–121.
- JOHANSSON, L., 1911. Hirudinea. Die Fauna Südwest-Australiens. Michaelson & Hartmeyer. Bd. 111 (12): 409–431.
- RICHARDSON, L. R., 1942. Observations on the migratory behaviour of leeches. *Can. Field Nat.* **46** (5): 67–70.
1968. An annotated list of Australian leeches. *Proc. Linn. Soc. N.S.W.* **92** (3): 227–245.
1969. A contribution to the systematics of the hirudinid leeches with descriptions of new families, new genera and species. *Acta Zool. Acad. Sci. Hung.* (in press).
- SOOS, A., 1968. A new leech genus: *Richardsonianus* gen. nov. (Hirudinoidea: Hirudinidae). *Acta Zool. Acad. Sci. Hung.* **14** (3–4): 455–459.
- VAILLANT, L., 1890. Histoire naturelle des anneles marin et d'eau douce. Vol. 3, part 2, Hirudiniens, pp. 477–542. (Roret: Paris).